State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Aquatic Resources
Honolulu, Hawaii 96813

July 26, 2013

Board of Land
and Natural Resources
Honolulu, Hawaii

Request for Authorization and Approval to Issue an Amendment to Papahānaumokuākea Marine National Monument Research Permit, PMNM-2012-049, issued to Dr. Robert Toonen, University of Hawaii, Hawaii Institute of Marine Biology, and Dr. Christopher Bird, Texas A&M University – Corpus Christi, for Access to State Waters to Conduct Intertidal Biodiversity Survey Activities

The Division of Aquatic Resources (DAR) hereby submits a request for your authorization and approval for issuance of an amendment to a Papahānaumokuākea Marine National Monument research permit no. PMNM-2012-049 issued to Dr. Robert Toonen, University of Hawaii, Hawaii Institute of Marine Biology, and Dr. Christopher Bird, Texas A&M University – Corpus Christi, pursuant to § 187A-6, Hawaii Revised Statutes (HRS), chapter 13-60.5, Hawaii Administrative Rules (HAR), and all other applicable laws and regulations. The research permit was approved by the BLNR on August 10, 2012 for activities occurring between September 1, 2012 to August 31, 2013.

The amendment, as described below, would continue to allow entry and activities to occur in Papahānaumokuākea Marine National Monument (Monument), including the NWHI State Marine Refuge and the waters (0-3 nautical miles) surrounding the following sites:

- Nihoa Island
- Necker Island (Mokumanamana)
- French Frigate Shoals
- Gardner Pinnacles

The activities covered under this amendment would occur between August 1 to August 31, 2013.

The amendment request is largely a continuation of work previously permitted and conducted in the Monument with the addition of collections from seven species not previously permitted.

INTENDED ACTIVITIES

The amendment request involves the following activities which support the original approved permit project's goals and objectives as follows:

1. Collect complementary data on the intertidal ecosystem with a suit of research scientists, cultural practitioners, and resource managers;

2. Establish a baseline survey of intertidal ecosystems, specifically focused on 'opihi species associations, relative abundance, and reproductive cycles to better understand the implications and consequences of climate change on these communities;

3. Determine the species present using joint morphological and molecular DNA analyses to characterize the biodiversity of the Hawaiian intertidal zone and their connectivity to one another across the archipelago;

4. To pinpoint the spawning timing of 'opihi and test where 'opihi larvae reside in the water column with plankton sampling; and

5. Begin to explore the mechanisms of adaptation to climate change and speciation in the sea using 'opihi as a model system to elucidate the mechanisms by which divergent selection can lead to adaptation radiation of marine species.

In the amendment, the applicants propose to continue with their research objectives and permitted activities. They are requesting additional samples of previously approved species and to sample seven species not included in the original approved permit. Three of the new species not previously permitted will be sampled non-lethally (*Octopus oliveri, Octopus cyanea,* and *Actinopya maurittiana*) and four will be sampled via lethal methods (*Heterocentrotus mammilatus, Echinothrix diadema, Acanthaster planci,* and *Tripneustes gratilla*) (Table 1).

Table 2: Proposed additional collections outlined in the amendment, including the seven new species, denoted as *, to the permit in the table proposed for collections.

Species	**Type**	**Lethal Collection**	**Nihoa**	**Necker Island**	**French Frigate Shoals**	**Gardner Pinnacles**
Nesochthamalus intertextus	Barnacle	Y	32	32	0	0
Isognomon californicum	Bivalve	Y	32	32	32	0
Smaragdinella calyculata	Bubble Shell	Y	32	0	0	0
Grapsus tenuicrustatus	Crab	N	32	32	32	0
Istiblennius zebra	Fish	N	32	0	0	0
Cellana exarata	Limpet	Y	136	105	95	94

Species	Type	Lethal Collection	Nihoa	Necker Island	French Frigate Shoals	Gardner Pinnacles
Cellana sandwicensis	Limpet	Y	116	118	144	94
Drupa ricina	Snail	N	32	32	32	0
Echinolittorina hawaiiensis	Snail	Y	32	32	32	0
Littoraria pintado	Snail	Y	32	32	32	0
Nerita picea	Snail	Y	32	32	4	0
Colobocentrotus atratus	Urchin	Y	32	32	0	0
Echinometra oblonga	Urchin	Y	32	0	0	0
Echinometra mathaei	Urchin	Y	32	0	0	0
Misc Algae	Algae	N	1000	1000	1000	0
*Octopus oliveri**	Octopus	N	32	32	32	32
*Octopus cyanea**	Octopus	N	32	32	32	32
*Actinopyga mauritiana**	Sea Cucumber	N	32	32	32	32
*Acanthaster planci**	Sea star	Y	32	32	32	32
*Heterocentrotus mammilatus**	Urchin	Y	32	32	32	32
*Echinothrix diadema**	Urchin	Y	32	32	32	32
*Tripneustes gratilla**	Urchin	Y	32	32	32	32

The approved permit application (item F-1b) allows the applicants plus seven other individuals to survey a maximum of 60 intertidal transects at each island and collect 15 target invertebrate species, one fish species, and algal species inhabiting each transect by hand across all island sites. Seven of the species approved in the permit for collection can be collected via non-lethal methods, while the remaining species can be collected by lethal methods. The numbers of specimens remaining to be collected from the approved permit are listed in Table 2. The applicants are also approved to collect egg specimens, voucher specimens of species they cannot visually identify in accordance with the Monument *Voucher Specimen Guidelines*, and conduct observational fish surveys 0 to 20 m from the shore line.

Table 2: Collections remaining under approved permit PMNM-2012-049.

Species	Type	Lethal Collection	Nihoa	Necker Island	French Frigate Shoals	Gardner Pinnacles
Nesochthamalus intertextus	Barnacle	Y	0	0	50	50
Isognomon californicum	Bivalve	Y	0	0	0	50
Smaragdinella calyculata	Bubble Shell	Y	0	50	50	50
Grapsus tenuicrustatus	Crab	N	0	0	0	50
Istiblennius zebra	Fish	N	0	49	50	50
Cellana exarata	Limpet	Y	8	39	49	50
Cellana sandwicensis	Limpet	Y	28	26	120	50
Drupa ricina	Snail	N	0	0	0	50
Echinolittorina hawaiiensis	Snail	Y	0	0	0	50
Littoraria pintado	Snail	Y	0	0	0	50
Nerita picea	Snail	Y	0	0	28	50
Colobocentrotus atratus	Urchin	Y	0	0	47	50
Echinometra oblonga	Urchin	Y	0	35	42	50
Echinometra mathaei	Urchin	Y	0	35	50	50
Misc Algae	Algae	N	0	0	0	1000

The activities proposed by the Applicant directly support the Monument Management Plan's priority management needs 3.1 – Understanding and Interpreting the NWHI (through action plan 3.1.1 – Marine Conservation Science).

The activities described above may require the following regulated activities to occur in State waters:

- ☒ Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving monument resource
- ☒ Swimming, snorkeling, or closed or open circuit SCUBA diving with a Special Preservation Area or Midway Atoll Special Management Area

REVIEW PROCESS:

The permit application for the original permit was sent out for review and comment to the following scientific and cultural entities: Hawaii Division of Aquatic Resources, Hawaii Division of Forestry and Wildlife, Papahānaumokuākea Marine National Monument (NOAA/NOS), NOAA Pacific Islands Regional Office (NOAA-PIRO), United States Fish and Wildlife Service Hawaiian and Pacific Islands National Wildlife Refuge Complex Office, and the Office of Hawaiian Affairs (OHA). In addition, the permit application was posted on the Monument Web site since June 29, 2012, giving the public an opportunity to comment. The application was posted within 40 days of its receipt, in accordance with the Monument's Public Notification Policy.

The amendment was also sent out for review and comment to the agencies listed. Amendments to approved permits are not required to be posted on the Monument Web site.

Comments received from the scientific community are summarized as follows:

Scientific reviews support the acceptance of this amendment.

The following concerns were raised. Applicant responses are noted below.

1. **We request that we (agency managers) follow up on these sites (after the activity take) with monitoring to ensure accumulation does not impact the resources. If the sponsoring agency cannot commit to monitoring, then we shouldn't grant these kinds of activities in the future.**

NOAA-ONMS does and will commit to monitoring the intertidal zones of Nihoa, Mokumanamana and French Frigate Shoals (FFS). ONMS monitors the intertidal zone annually in the same areas at Nihoa, Mokumanamana, and FFS in which permitted sampling of various invertebrate species occurred the prior year. ONMS is a managing agency and funds this monitoring work 100%. The project is led by two experts: Kehau Springer (Native Hawaiian cultural practitioner and 'opihi expert) and Dr. Chris Bird (scientist and 'opihi expert).

Previous permitted intertidal monitoring efforts suggests the take activity is beneficial for the resource. Dr. Bird explains, "This [2011] is the third year of intertidal data for Papahānaumokuākea, and we are now seeing some change over time. For example, the high density of recruits that we saw in June 2010, didn't all survive. Basically, more 'opihi settled on the shore than the habitat could sustain. In 2010 we saw lots of small one-month old 'opihi (300 per m^2), this year there was less 1.5 year old 'opihi (50 per m^2)" (http://www.papahanaumokuakea.gov/news/opihi/opihi_chris_b.html).

Comments received from the Native Hawaiian community are summarized as follows:

Cultural reviews support the acceptance of this amendment.

Comments received from the public are summarized as follows:

No comments were received from the public on this application.

Additional reviews and permit history:

Are there other relevant/necessary permits or environmental reviews that have or will be issued with regard to this project? (e.g. MMPA, ESA, EA) Yes ☒ No ☐
If so, please list or explain:

- The proposed activities are in compliance with the National Environmental Policy Act.
- The proposed activities are in compliance with the National Historic Preservation Act.
- The proposed activities are in compliance with the Endangered Species Act. A formal consultation was conducted in 2011 analyzing the effects of the proposed activities within Hawaiian monk seal critical habitat and re-initiated in 2012 analyzing the effects of the proposed activities with the presence of Hawksbill sea turtles in the area. A letter of concurrence was issued on August 27, 2012 from NOAA-NMFS to NOAA-ONMS stating there was not likely to be an adverse effect to the aforementioned species or their habitat.
- The Department has made an exemption determination for this permit in accordance chapter 343, HRS, and Chapter 11-200, HAR. See Attachment ("DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200 HAR, FOR AMENDMENT TO PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMIT ISSUED TO DR. ROBERT TOONEN, UNIVERSITY OF HAWAII, HAWAII INSTITUTE OF MARINE BIOLOGY, AND DR. CHRISTOPHER BIRD, TEXAS A&M UNIVERSITY – CORPUS CHRISTI, FOR ACCESS TO STATE WATERS TO CONDUCT INTERTIDAL BIODIVERSITY SURVEY ACTIVITIES UNDER PERMIT PMNM-2012-049")

Has Applicant been granted a permit from the State in the past? Yes ☒ No ☐
If so, please summarize past permits:

Have there been any a) violations: Yes ☐ No ☒
b) Late/incomplete post-activity reports: Yes ☒ No ☐

Are there any other relevant concerns from previous permits? Yes ☐ No ☒

STAFF OPINION:

DAR staff is of the opinion that Applicant has properly demonstrated valid justifications for his application and should be allowed to enter the NWHI State waters and to conduct the activities therein as specified in the approved permit and amendment with certain special instructions and conditions, which are in addition to the Papahānaumokuākea Marine National Monument Research Permit General Conditions. All suggested special conditions have been vetted through the legal counsel of the Co-Trustee agencies (see Recommendation section).

MONUMENT MANAGEMENT BOARD OPINION:

The MMB is of the opinion that the Applicant has met the findings of Presidential Proclamation 8031 and this activity may be conducted subject to completion of all compliance requirements. The MMB concurs with the special conditions recommended by DAR staff.

RECOMMENDATION:

Based on the attached proposed declaration of exemption prepared by the department after consultation with and advice of those having jurisdiction and expertise for the proposed permit actions:

1. That the Board declare that the actions which are anticipated to be undertaken under this permit will have little or no significant effect on the environment and is therefore exempt from the preparation of an environmental assessment.

2. Upon the finding and adoption of the department's analysis by the Board, that the Board delegate and authorize the Chairperson to sign the declaration of exemption for purposes of recordkeeping requirements of chapter 343, HRS, and chapter 11-200, HAR.

3. That the Board authorize and approve an amendment to approved Research Permit issued to Dr. Robert Toonen, University of Hawaii, Hawaii Institute of Marine Biology, and Dr. Christopher Bird, Texas A&M University – Corpus Christi, with the following special conditions:

a. This permit is not to be used for nor does it authorize the sale of collected organisms. Under this permit, the authorized activities must be for noncommercial purposes not involving the use or sale of any organism, by-products, or materials collected within the Monument for obtaining patent or intellectual property rights.

b. The permittee may not convey, transfer, or distribute, in any fashion (including, but not limited to, selling, trading, giving, or loaning) any coral, live rock, or organism collected under this permit without the express written permission of the Co-Trustees.

c. To prevent introduction of disease or the unintended transport of live organisms, the permittee must comply with the disease and transport protocol attached to this permit.

d. Tenders and small vessels must be equipped with engines that meet EPA emissions requirements.

e. Refueling of tenders and all small vessels must be done at the support ships and outside the confines of lagoons or near-shore waters in the State Marine Refuge.

Respectfully submitted,

William M. Tam
Acting Administrator

APPROVED FOR SUBMITTAL

William J. Aila, Jr.
Chairperson

Chris Bird Permit Amendment Request Rev. 1 6/13/2013
Permit No. PMNM-2012-049

Amendment Request for August 2013 Intertidal Cruise (Tentatively scheduled for 8/6/2013 – 8/18/2013):

We hope to characterize yearly variation in opihi and other intertidal and shallow subtidal populations in PMNM. Further, new genetic techniques that allow us to more fully sequence the genomes of individuals require more stringent sample preservation protocols than were used in the past collections of specimens from PMNM. Using these newer population genomic techniques, we can ascertain a more highly resolved image of connectivity and self recruitment on the islands of PMNM, that include the assessment of unique selective pressures driving local adaptation on the inhabitants of each island.

In order to track 'opihi reproductive cycles, we will continue the work started on our 2011-12 cruises where we targeted 50 'opihi per species per island for gonad index analysis in collaboration with Kehau Springer. The 2013 cruise will begin on the new moon, when opihi spawn, and end on the full moon. We plan to collect 24 individuals per 1 cm size class (<1, 1-2 ,2-3 ,3-4 , 4-5, >5cm) species on each island, and transport them to the boat. Trizol will be stored in plastic unbreakable tubes inside of plastic containment containers (5gal buckets). On the ship, we will dissect the 'opihi to separate the gonad, the non-gonadal tissue, and the shell for subsequent weighing at HIMB on O'ahu. The wet weight of the gonad and non-gonadal tissue will be weighed and compared to assess reproductive state for males and females allowing us to estimate reproductive state. Tissues will be preserved by freezing in liquid nitrogen and storage in Trizol reagent (a monophasic solution of phenol and guanidine isothiocyanate designed for and proven to be the best method of preventing the degradation of DNA and RNA in marine invertebrate samples).

The combination of size class sampling and genomic DNA sequencing will allow us to conduct a survey of connectivity and self recruitment on an unprecedentedly fine scale in PMNM. We are still processing genetic samples from 2012 that were collected and processed in this vein, and we are finding genetic patterns on the scale of meters. Now that our new laboratory is set up at Texas A&M, new results will be produced quickly, and we are actively seeking PostDoc funding to help publish the present culmination of the intertidal and shallow subtidal cruise surveys.

In 2012, we detected a difference in the onset of reproductive maturity on Mokupapapa. Often when fishery species are managed with a size limit, the size at reproductive maturity decreases due to selective pressure for younger maturation. We are going to test this hypothesis by comparing the size of reproductive maturity for 'opihi inside and outside of PMNM. To do this, the opihi listed above will be preserved and analyzed for gonad index in the laboratory with the other 'opihi.

A new addition to our protocol is that, when possible, we will extract the DNA from live opihi tissues on the ship at the conclusion of each day in order to avoid sample degradation that interferes with new genome-wide genetic surveys. All waste will be retained on the ship, and

kept in primary and secondary containment vessels. Waste will be disposed of at the University of Hawaii on Oahu. DNA extraction involves chaotropic salts, guanidine, SDS, sodium azides, and ethanol.

As stated above, the previously employed technique of preserving tissue samples in ethanol for DNA analysis has resulted in samples that cannot be genomically analyzed. In 2012, we employed a new sample preservation method with opihi, preservation in liquid nitrogen, that was much more successful. Since then, we have found that either preservation in TRIsol reagent or extracting and stabilizing DNA from live tissue is the best method to preserve the high quality DNA required for genomic analysis, and we have developed a field DNA extraction kit to do so. With this proven strategy, we wish to resample the other animal species that we originally collected up to 50 individuals for in 2011 and 2012 (along with the addition of *Octopus oliveri, Octopus cyanea, Actinopyga mauritiana, Heterocentrotus mammilatus, Echinothrix diadema, Acanthaster planci, and Tripneustes gratilla*) for the first multispecies population genomic study in the Hawaiian Islands, and most likely the world. PIs Chris Bird and Rob Toonen have optimized genomic survey protocols. Kelly Pennoyer, a PhD student in Chris Bird's lab, is working on this project in the main Hawaiian Islands for her dissertation and would also process the PMNM samples. 32 specimens per species per island would be collected in 2013 (Appendix 1).

Hazardous Materials Ammended List for August 2013 Cruise:

Tissue preservative solutions for DNA analyses include: 95% ethanol (EtOH), RNALater; and TRIzol, (MSDS provided upon request.) These chemicals will be double contained (plastic bottles inside of sealed buckets), we be used within Rubbermaid containment basins, and all waste will be double contained and disposed of at the University of Hawaii.

Amended Tentative List for August 2013 Cruise:
Chris Bird (Ph.D., Asst Professor, TAMUCC),
Rob Toonen (Ph.D., Assoc. Researcher, HIMB),
Levi Lewis (Ph.D. Candidate , Scripps Institution of Oceanography)
Hoku Johnson (PMNM, Resource manager)
Matt Ramsey (former DAR Resource manager, NOAA Fisheries manager)
Shauna Kehaunani Springer (Conservation International)
Makani Gregg
Bert Hispanola (Cultural Practitioner)
James Hispanola (Cultural Practitioner)
Russell Amimoto (Nature Conservancy)
Patrick Springer (Na Maka o Papahānaumokuākea)
Nakoa Goo (NOAA)
TBD Kaua'i Cultural Practitioner

Appendix 1. Proposed Additional Collections for Permit No. PMNM-2012-049

Note: New species are highlighted

2013 Collection List

Species	Type	Distribution	Sampling	Nihoa	Mokumanamana	Mokupāpapa (French Frigate Shoals)	Pūhāhonu (Gardner Pinnacles)	Preserve Tissue For Genetic Analysis
Nesochthamalus intertextus	Barnacle	Hawaii	Lethal	32	32	0	0	Y
Isognomon californicum	Bivalve	Hawaii	Lethal	32	32	32	0	Y
Smaragdinella calyculata	Bubble Shell	Indo-Pac	Lethal	32	0	0	0	Y
Grapsus tenuicrustatus	Crab	Indo-Pac	Non-lethal	32	32	32	0	Y
Istiblennius zebra	Fish	Hawaii	Non-lethal	32	0	0	0	Y
Octopus oliveri	Octopus	Indo-Pac	Non-Lethal	32	32	32	32	Y

Octopus cyanea	Octopus	Indo Pac	Non Lethal	32	32	32	32	Y
Drupa ricina	Snail	Indo-Pac	Non-lethal	32	32	32	0	Y
Echinolittorina hawaiiensis	Snail	Hawaii	Lethal	32	32	32	0	Y
Littoraria pintado	Snail	Indo-Pac	Lethal	32	32	32	0	Y
Nerita picea	Snail	Hawaii	Lethal	32	32	4	0	Y
Cellana exarata	Limpet	Hawaii	Lethal	136	105	95	94	Y
Cellana sandwicensis	Limpet	Hawaii	Lethal	116	118	144	94	Y
Colobocentrotus atratus	Urchin	Indo-Pac	Lethal	32	32	0	0	Y
Echinometra oblonga	Urchin	Indo-Pac	Lethal	32	0	0	0	Y
Echinometra mathaei	Urchin	Indo-Pac	Lethal	32	0	0	0	Y
Heterocentrotus mammilatus	Urchin	Indo-Pac	Lethal	32	32	32	32	Y

Echinothrix diadema	Urchin	Indo-Pac	Lethal	32	32	32	32	Y
Acanthaster planci	Sea star	Indo-Pac	Lethal	32	32	32	32	Y
Actinopyga mauritiana	Sea Cucumber	Indo-Pac	Non Lethal	32	32	32	32	Y
Tripneustes gratilla	Urchin	Indo-Pac	Lethal	32	32	32	32	Y
Misc Algae	algae	various	Non-lethal	1000	1000	1000	0	Y

Papahānaumokuākea Marine National Monument

RESEARCH Permit Application

NOTE: ***This Permit Application (and associated Instructions) are to propose activities to be conducted in the Papahānaumokuākea Marine National Monument. The Co-Trustees are required to determine that issuing the requested permit is compatible with the findings of Presidential Proclamation 8031. Within this Application, provide all information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historic, and cultural resources of the Papahānaumokuākea Marine National Monument (Monument).***

ADDITIONAL IMPORTANT INFORMATION:

- Any or all of the information within this application may be posted to the Monument website informing the public on projects proposed to occur in the Monument.

- In addition to the permit application, the Applicant must either download the Monument Compliance Information Sheet from the Monument website OR request a hard copy from the Monument Permit Coordinator (contact information below). The Monument Compliance Information Sheet must be submitted to the Monument Permit Coordinator after initial application consultation.

- Issuance of a Monument permit is dependent upon the completion and review of the application and Compliance Information Sheet.

INCOMPLETE APPLICATIONS WILL NOT BE CONSIDERED

Send Permit Applications to:
Papahānaumokuākea Marine National Monument Permit Coordinator
6600 Kalaniana'ole Hwy. # 300
Honolulu, HI 96825
nwhipermit@noaa.gov
PHONE: (808) 397-2660 FAX: (808) 397-2662

SUBMITTAL VIA ELECTRONIC MAIL IS PREFERRED BUT NOT REQUIRED. FOR ADDITIONAL SUBMITTAL INSTRUCTIONS, SEE THE LAST PAGE.

F-1b

Papahānaumokuākea Marine National Monument
Permit Application Cover Sheet

This Permit Application Cover Sheet is intended to provide summary information and status to the public on permit applications for activities proposed to be conducted in the Papahānaumokuākea Marine National Monument. While a permit application has been received, it has not been fully reviewed nor approved by the Monument Management Board to date. The Monument permit process also ensures that all environmental reviews are conducted prior to the issuance of a Monument permit.

Summary Information

Applicant Name: Robert J. Toonen[1] & Christopher E. Bird[2]
Affiliation:
[1]Hawai'i Institute of Marine Biology, University of Hawai'i at Mānoa
[2]Marine Biology Program, Texas A&M University – Corpus Christi

Permit Category: Research
Proposed Activity Dates: September 12- 25 2012
Proposed Method of Entry (Vessel/Plane): Vessel, the Searcher
Proposed Locations: Intertidal and shallow water habitats around basaltic islands on which 'opihi occur. Specifically, Nihoa Island, Mokumanamana Island, French Frigate Shoals (La Perouse Pinnacle), and Gardner Pinnacles

Estimated number of individuals (including Applicant) to be covered under this permit: Twelve total people will be covered under this permit, co-listed under the Native Hawaiian Practices application submitted by Shauna Kehaunani Springer.

Estimated number of days in the Monument: approximately 12 days

Description of proposed activities: (complete these sentences):

a.) The proposed activity would…

aim to examine the biodiversity of the Hawaiian intertidal and shallow subtidal ecosystem, and study the basic ecology of 'opihi populations within the NWHI. Additionally, we propose to conduct a comprehensive biodiversity survey of the intertidal zone in the NWHI and quantify species presence/absence and relative abundances within and among sites across the basaltic emergent islands. To this end we will sample species of uncertain taxonomy for combined morphological and DNA bar-coding analyses. We also seek to examine population connectivity of intertidal species in comparison to the broad survey of coral reef organisms sampled to date. We find different patterns of larval exchange among the 'opihi which suggests that intertidal species may differ from the average seen in subtidal taxa, and that has important management implications that need to be confirmed. We propose to examine the reproductive status, timing, and depth of larvae in select 'opihi populations across the NWHI to better understand natural population dynamics and potential mechanisms of speciation in these economically, ecologically

and culturally important limpets. Finally, we propose to evaluate the ability of 'opihi to respond to and tolerate heat stress in order to assess adaptive capacity in the face of global warming, especially on the 'opihi 'alinalina of LaPerouse Pinnacles that have abandoned their cool mid shore habitat for the hotter high shore habitat.

This work will be tightly linked with the Native Hawaiian cultural practice application and is a joint collaborative study among Na Mamo o Muole'a, the Nature Conservancy, the Hawai'i Institute of Marine Biology, Friends of Papahānaumokuākea, and the NOAA Papahānaumokuākea Marine National Monument. We will perform the standardized 'opihi monitoring protocol developed through this collaboration, which is inclusive of Hawaiian methods of monitoring, has was specifically developed (and is continuously being refined) to monitor intertidal populations associated with 'opihi across the Main and Northwestern Hawaiian Islands. To date, communities on the Big Island of Hawai'i, Maui, Kaho'olawe, Lana'i and through these efforts the NWHI have been surveyed for intertidal species composition, population size and age structure of organisms associated with 'opihi. Here we request a permit to conduct the fourth year of surveys and monitoring within the NWHI.

b.) To accomplish this activity we would ....
conduct standardized surveys developed collaboratively among the partners listed above to integrate quantitative scientific data collection with Native Hawaiian observational data. In addition, we will collect some target invertebrates by hand for taxonomic study (combined morphological and DNA-sequence based "bar-coding") where species identity is in question. We will collect small tissue samples from a handful of very common intertidal species to examine patterns of population connectivity in the intertidal zone and compare that directly to the patterns found in subtidal species, and some 'opihi will be collected for gonad index and heat stress tolerance experiments as outlined below and in the accompanying Native Hawaiian Practices Permit Application filed by Kehau Springer. Specifically, we will lay between 20 and 60 belt transects per island or atoll to assess class size, population density, community structure, species range, distribution, and rugosity for all identifiable organisms within the intertidal zone. In order to pin-point 'opihi spawning timing, 20 egg baskets (1.5" diameter x 3" long PVC tubes with 20um nitex mesh enclosing 'opihi eggs) will be deployed/collected in the morning and evening at each island. When the ship leaves the island, no supplies will be left behind. Fifty plankton samples per island will be collected to identify the depth of different larval species in the water column. Collected 'opihi will be kept alive for heat stress trials (up to 50°C) aboard the ship prior to preservation. The samples we request to be collected for this work are summarized in Appendix 1. All data will be stored and analyzed at the Hawai'i Institute of Marine Biology by co-PIs Toonen & Bird. These data will be useful to both the Monument, as well as to local and governmental resource managers in the Main Hawaiian Islands to make effective decisions on managing the resources.

c.) This activity would help the Monument by ...
providing baseline knowledge of one of the least studied and potentially most threatened by climate change of all ecosystems in the Hawaiian archipelago. Sea level rise is inevitable at this

point, and the first community to feel the effects of climate change will be the one that lives at the interface of land and sea and experiences the greatest extremes of both environments: the intertidal. Limited knowledge of this ecosystem restricts our understanding of climate change impacts and suitable responses. Further, knowing which species occur and where they live is fundamental to the management of natural resources in any ecosystem, and the Hawaiian intertidal zone is poorly characterized in general. We will also confirm whether or not the intertidal species show a different pattern of population connectivity across the archipelago than do the subtidal ones surveyed to date. These data will provide the continued quantitative data on the species present in these ecosystems, their biodiversity, population dynamics and connectivity and also contribute to the ongoing debate about how new species arise in the sea. The tight collaboration of the team comprised of cultural practitioners, research scientists, and resource managers will ensure that the findings are of relevance to a broad group of stakeholders and of direct relevance to the people of Hawai'i.

Other information or background: Littoral habitats, those lying between the low-tide line and the upper limit of aquatic species on the shore, are among the most studied and well-known aquatic habitats on the planet. A primary exception to that generalization is that this zone is one of the least studied in Hawai'i. The effects of tides on littoral marine habitats are so ubiquitous that shorelines are commonly described as 'intertidal', whereas waves are considered a secondary factor that simply modifies the intertidal habitat. However in Hawai'i, mean significant wave height exceeds tidal range most of the time, and may be a primary structuring force for littoral communities as outlined in Bird (2006). The patterns of distribution and abundance of organisms on rocky shores, in particular the upper and lower limits of species, along vertical gradients of exposure have been studied extensively in other regions of the globe. Hypotheses addressing the causes of biotic zonation and community structure have evolved from strictly physical to an inseparable combination of physical and biological factors, including physiological tolerance (Connell 1961a b), species interactions (Bruno & Bertness 2001, Menge & Branch 2001), and all other forms of biotic factors.

A fundamental advance in the understanding of biotic zonation on rocky shores was the demonstration that species interactions also affected zonation patterns, where biotic factors generally affect the lower limit of distribution and physical factors affect the upper limit of distribution (Connell 1961a b, Paine 1967). A number of exceptions to this generalization have been demonstrated, many of which highlight the more general effect of biological interactions on the realized distribution of a species. Ultimately, the inseparable interaction between physical and biological factors define the realized limits of species (Denny & Wethey 2001), and intertidal communities are unique in that organisms must cope with some of the most severe extremes of both marine and terrestrial environments. This has led to debate about whether these species are so hardy that they are resistant to change, or whether they live in such extreme environments that climate change will impact them more (e.g., Stillman 2003). Available data from long-term surveys of the intertidal community in California suggest the latter: intertidal communities are one of the first to show ecosystem impacts of climate change that can already be documented and are expected to accelerate given future climate change scenarios (e.g., Barry et al 1995; Sagarin et al. 1999).

Section A - Applicant Information

1. Applicant

Name (last, first, middle initial):

Toonen, Robert J.
Associate Researcher, HIMB, University of Hawai'i at Mānoa

Bird, Christopher E.
Assistant Professor, Texas A&M University - Corpus Christi

1a. Intended field Principal Investigator (See instructions for more information):
Chris Bird

2. Mailing address (street/P.O. box, city, state, country, zip):

Rob Toonen
[redacted]

Chris Bird
[redacted]

3. Affiliation (institution/agency/organization directly related to the proposed project):
HIMB, University of Hawai'i at Mānoa
Marine Biology Program, Texas A&M University - Corpus Christi

4. Additional persons to be covered by permit. List all personnel roles and names (if known at time of application) here (e.g. John Doe, Research Diver; Jane Doe, Field Technician):

We expect that the final list of cruise personnel will be available soon, but has not yet been finalized. We seek a crew of 12 people drawn from across the partners listed above and these are the same participants as those on the Native Hawaiian Practices Permit Application filed by Kehau Springer.
We expect that the scientific crew will likely consist of 3 to 4 members, likely drawn from the following list or their equivalent expertise:
Chris Bird (Ph.D., Asst Professor, TAMUCC),
Rob Toonen (Ph.D., Assoc. Researcher, HIMB),
Jennifer Smith (Ph.D., Asst Professor, Scripps Institution of Oceanography)
Roxie Silva (Nature Conservancy)
Hoku Johnson (PMNM, Resource manager)
Matt Ramsey (former DAR Resource manager, NOAA Fisheries manager)
Shauna Kehaunani Springer (MS, 'opihi researcher & cultural practitioner)

Additional crew members will be selected from Native Hawaiian communities as outlined in the Springer permit application and be included here as co-listed permittees for a maximum of 12 people in total.

Section B: Project Information

5a. Project location(s):

		Ocean Based	
☒ Nihoa Island	☒ Land-based	☒ Shallow water	☐ Deep water
☒ Necker Island (Mokumanamana)	☒ Land-based	☒ Shallow water	☐ Deep water
☒ French Frigate Shoals	☒ Land-based	☒ Shallow water	☐ Deep water
☒ Gardner Pinnacles	☒ Land-based	☒ Shallow water	☐ Deep water
☐ Maro Reef			
☐ Laysan Island	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Lisianski Island, Neva Shoal	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Pearl and Hermes Atoll	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Midway Atoll	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Kure Atoll	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Other			

NOTE: There is a fee schedule for people visiting Midway Atoll National Wildlife Refuge via vessel and aircraft.

Location Description:
As outlined above, our survey and collection efforts will be concentrated in the intertdial zone, surrounding each emergent basaltic land mass on which 'opihi occur. Although we include this within the land-based category above, the monitoring team would not access any sites beyond the splash zone on any island.

5b. Check all applicable regulated activities proposed to be conducted in the Monument:
☒ Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving Monument resource
☒ Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, placing, or abandoning any structure, material, or other matter on the submerged lands
☐ Anchoring a vessel
☐ Deserting a vessel aground, at anchor, or adrift
☐ Discharging or depositing any material or matter into the Monument
☐ Touching coral, living or dead
☐ Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the Monument
☐ Attracting any living Monument resource
☐ Sustenance fishing (Federal waters only, outside of Special Preservation Areas, Ecological Reserves and Special Management Areas)
☐ Subsistence fishing (State waters only)
☒ Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

6 Purpose/Need/Scope ***State purpose of proposed activities:***
The primary objectives of this research expedition are to: (1) collect complementary data on the intertidal ecosystem with a suite of research scientists, cultural practitioners, and resource managers; (2) establish a baseline survey of intertidal ecosystems, specifically focused on 'opihi species associations, relative abundance, and reproductive cycles to better understand the implications and consequences of climate change on these communities; (3) determine the species present using joint morphological and molecular DNA analyses to characterize the biodiversity of the Hawaiian intertidal zone and their connectivity to one another across the archipelago; (4) to pinpoint the spawning timing of 'opihi, determine the size of reproductive maturity in the absence of human predation, and test where 'opihi larvae reside in the water column with plankton surveys; and (5) begin to explore the mechanisms of adaptation to climate change and speciation in the sea using 'opihi as a model system to elucidate the mechanisms by which divergent selection can lead to adaptive radiation of marine species.

Along these same lines we request permission to collect up to 3 voucher specimens of an individual organism that cannot be identified as a known species and/or may represent new geographic records or new species from the taxonomic groups under study as laid forth in the voucher specimen guidelines of the Monument. Voucher specimen(s) would be used for taxonomic study to determine the species identity and would be accessioned in an approved repository such as the Bishop and/or Smithsonian museum permanent collections as recommended.

7. Answer the Findings below by providing information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historic, and cultural resources of the Monument:

The Findings are as follows:

a. How can the activity be conducted with adequate safeguards for the cultural, natural and historic resources and ecological integrity of the Monument?
Most activities in this permit application were previously permitted and have demonstrated no impact on Monument cultural, natural and historic resources. Even the activities that have not previously been permitted within the scope of this work have been conducted safely within the scope of previously permitted research. Our research team consists of conservation biologists who are both teaching and studying the science of how best to manage and conserve biological diversity in the sea. As such, minimizing our impact to the ecosystem we are trying to conserve is naturally and inherently a top priority for any research we conduct, especially within the boundaries of the Monument. We believe that we have implemented every reasonable safeguard for the natural resources and ecological integrity of the Monument in our research, and we do not conduct research that could have a detectable impact to the ecosystem. We have an established track record of management-relevant research in this area and have not been able to detect any cumulative impacts of scientific collections to date (Selkoe et al. 2009). As outlined in greater detail below, our sample size, choice of species, and methodologies have all been selected to provide robust and scientifically rigorous information to managers with the least possible impact

to the natural resources of the Monument. We will adhere to all rules, regulations and best practices established by the co-trustees for the Monument, including all quarantine requirements, wildlife viewing guidelines, and entry/exit notification procedures where applicable.

Additionally, our team has always tried and will continue to ensure that we have minimal impact on the cultural resources of Papahānaumokuākea. We rely on our colleagues who are cultural practitioners to take the lead on proper protocols for our voyage, and these are outlined in detail in the accompanying permit application by Springer. Regardless, each member of our team is already aware of the unique ecological and cultural status of the Monument, and our on-going collaboration with the cultural practitioners continues to expand our understanding of Hawaiian protocol in conducting research within Papahānaumokuākea Marine National Monument.

In addition to following the lead of our cultural practitioner team-mates, we ask that each researcher take responsibility to prepare an appropriate offering in advance to ensure that they reflect on why they are on this trip, what is the purpose of the trip, and enter the Monument with the proper intent. It is respectful to provide an offering and to not go forth to take from the place with empty hands. However, given concerns regarding transport of materials into the Monument, it is also difficult to present a proper offering in the form of a gift. In previous years, we have used pure rainwater collected by hand to ensure a personal connection with the offering, and we believe that this is the best option for research scientists unfamiliar with the proper cultural protocols. This fresh-caught rainwater can be autoclave sterilized (to ensure no biological transport) and poured out as a personal offering in return for the privilege of collecting samples in the Monument by each member of our team. In addition we will follow the lead and participate to the best of our ability in protocols undertaken by our cultural colleagues in whatever preparation is appropriate for the voyage.

b. How will the activity be conducted in a manner compatible with the management direction of this proclamation, considering the extent to which the conduct of the activity may diminish or enhance Monument cultural, natural and historic resources, qualities, and ecological integrity, any indirect, secondary, or cumulative effects of the activity, and the duration of such effects? With the exception of the use of egg baskets and plankton sampling to pinpoint the spawning timing of 'opihi and the location of their larvae within the Monument, all research proposed herein has been permitted previously and furthermore was conducted without detectable impact in the past. Our expansion of the scope of the initial surveys to include biodiversity surveys and connectivity work in the intertidal is similar to the work that we have done previously for subtidal reef-associated organisms, and has been done without detectable cumulative impact to date. Our proposed survey of the reproductive status, spawning timing, and larval behavior of 'opihi is likewise expected to have no detectable impact, but will provide valuable scientific and management information for the entire Hawaiian Archipelago. This type of research is directly mandated by the Proclamation, and is necessary to both maintain ecosystem integrity and provide for adaptive ecosystem management in the face of natural or anthropogenic disasters and global climate change. As outlined above and below, our activities have no detectable effect to diminish Monument resources, nor have any known indirect, secondary or cumulative effects on the ecosystem or resources therein. Because we are conservation biologists who are concerned about exactly these sort of impacts, we have voluntarily conducted a threat assessment of the

activities in the Monument (Selkoe et al. 2008) and compiled a cumulative impact threat map of the Monument (Selkoe et al. 2009) which has been provided to the co-trustees for use in future management decisions.

c. Is there a practicable alternative to conducting the activity within the Monument? If not, explain why your activities must be conducted in the Monument.

We expect it is self-evident that there is no practical alternative to sampling within the Monument when the goal of the research is to understand the baseline ecosystem state of the intertidal populations within the Monument. Likewise, surveys of biodiversity within understudied habitats of the Monument which seek to determine the species present, their abundance and distribution are only possible within the bounds of the region of interest. Finally, these studies will be of both direct benefit to the resource management within the Monument itself, and to the remainder of the Hawaiian Archipelago for ecologically, economically and culturally important species such as 'opihi.

The exceptions that may not seem quite so self-evident is the examination of gonad index, spawning timing, larval behavior, and heat tolerance within the Monument. The reproductive and larval work is needed to examine the baseline state of the populations in the absence of human harvest and will provide important information about spawning capacity, timing and ability of larvae to return to their source island. In 2011 we found differences in the reproductive state of ‘opihi between islands and species that could have important implications for the connectivity of populations among islands. Finally, ‘opihi are a unique system in which to study speciation in the sea and understand how Hawaiian biodiversity has been generated and altered by climate change. LePerouse Pinnacles at Mokupāpapa is the only island where ‘opihi makaiauli and ‘opihi ‘alinalina are morphologically identical, reside in the same habitat above the crustose coralline algae zone, due to an evolutionary shift in ‘alinalina to the hotter and drier high shore. We are proposing to extract additional data from ‘opihi specimens that are being collected for reproductive and DNA analysis, but subjecting them to heat stress tests that will allow us to directly test for differential adaptations and capacity to tolerate a warming climate among species and islands. ‘Alinalina at LaPerouse Pinnacles can provide a window into the future for ‘alinalina on other islands because they are already inhabiting a hotter section of the shoreline.

d. How does the end value of the activity outweigh its adverse impacts on Monument cultural, natural and historic resources, qualities, and ecological integrity?

Given that we can detect no adverse effects of our activities on the resources of the Monument, we believe that the end value of this research clearly outweighs whatever imperceptible impact exists. We have an established track record of communicating our findings to the resource managers and making sure that all research conducted within the Monument meets the bar of management relevance. The proposed research will provide a quantitative baseline survey of intertidal ecosystems across the Hawaiian Archipelago and address questions of vulnerability to climate change. Additionally, the reproductive work proposed herein will benefit both population studies and resource management of ‘opihi stocks in Hawai‘i, but also contribute to

our understanding of how new species can arise in the sea. Finally, the intertidal zone is a greatly understudied ecosystem that is likely to be one of the most directly and immediately impacted by climate change because it experiences the extremes of both terrestrial and marine environments daily. An understanding of the intertidal communities across this region will identify potentially vulnerable locations and species, and (as outlined above) greatly increase the decision-making capacity of the co-trustees in dealing with the reality of future climate change within the Monument and the Hawaiian Archipelago in general.

e. Explain how the duration of the activity is no longer than necessary to achieve its stated purpose.

The expedition length is determined by limited funding, which makes it shorter than ideal, and is certainly no longer than is necessary to accomplish the research goals outlined in this permit application.

f. Provide information demonstrating that you are qualified to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

Rob Toonen has a PhD in Population Biology, is an Associate Researcher at HIMB, and has published ~200 research papers in peer-reviewed journals dealing specifically with the subject of conservation and management of Hawaiian natural resources. Chris Bird has a PhD in Ecology, Evolution, and Conservation Biology, was recently awarded an Assistant Professorship and has published ~20 research papers in peer-reviewed journals dealing specifically with the subject of conservation and management of Hawaiian natural resources, rocky shores in particular. With Rob Toonen and Celia Smith, Chris has been studying 'opihi and Hawaiian intertidal communities since 1999, before to the establishment of the Monument. This research has been of considerable interest to both the science and management community of Hawai'i and has begun to receive international recognition for the insights we are gaining to understand divergent selection leading to speciation in the sea. This on-going project should be well known to the Monument co-trustees, and our research accomplishments are presented in regular meetings with the management community and semi-annual meetings. Our accomplishments and qualifications to perform this research are further documented in the included CVs. We will be responsible for the conduct of the scientific team and work closely with the cultural practitioner team to ensure a successful mission.

g. Provide information demonstrating that you have adequate financial resources available to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

This mission requires no specific funding beyond the cost of mounting the expedition to complete the research goals. The proposed field activities are funded in full by NOAA for the Papahānaumokuākea Marine National Monument. The data analysis and storage will be supported by the Monument as necessary, the Hawai'i Institute of Marine Biology, and Texas A&M University. As a new faculty at Texas A&M, Chris Bird's startup package includes funds for three graduate students, as well as ~$500,000 in equipment and supplies required to conduct research. The success of the unfunded 'opihi partnership demonstrates our collective

commitment to this effort and our ability to complete this sort of work voluntarily even in the absence of funding. We are able to leverage the existence of samples to obtain federal funding from a variety of sources, and have an established track record of doing exactly that. We also have a clearly established track record of completing and publishing the research conducted in the Papahānaumokuākea Marine National Monument on a reasonable time frame, and have every intention to continue that tradition. Finally, we provide regular individual research updates to the management community and will also continue that effort in the future.

h. Explain how your methods and procedures are appropriate to achieve the proposed activity's goals in relation to their impacts to Monument cultural, natural and historic resources, qualities, and ecological integrity.

Our choice of sites are guided by personal safety and natural resource concerns within the Monument, but are constrained by the fact that intertidal communities that support 'opihi populations are limited to basaltic emergent islands. Minimizing our impact on the natural resources of the Monument is critical to us because they are the focus of the study for purposes of conservation, and we absolutely do not want to detract from that system we are seeking to conserve. The methods and procedures we propose to use are widely accepted and are among the few that directly incorporate Native Hawaiian marine practitioners, resource managers and research scientists in collaborative study that is co-designed and jointly implemented. Our success in obtaining extramural funding, our rate of publication in high quality scientific journals, and the frequency with which those studies are cited all show that the work being performed is accepted, valued and endorsed by the global scientific community. Belt transects do not require any specialized equipment and are simple enough to be employed by community members without scientific training across the inhabited Main eight Hawaiian Islands. All our work takes full account the unique value and seeks to minimize any potential for impact to the Monument resources. No more than 11 people will be on land at any one time.

i. Has your vessel has been outfitted with a mobile transceiver unit approved by OLE and complies with the requirements of Presidential Proclamation 8031?

We will be chartering the Searcher and the partner NOAA PMNM staff will ensure it meets the VMS type-approval requirement as stated in Monument regulations.

j. Demonstrate that there are no other factors that would make the issuance of a permit for the activity inappropriate.

There are no other factors that would make the issuance of the permit inappropriate. The activity is non-commercial. The end-value of the activity is informational and is intended solely to provide local and governmental managers with information critical to the conservation of natural resources.

8. Procedures/Methods:

The primary objectives of this research expedition are to: (1) collect complementary data on the intertidal ecosystem with a suite of research scientists, cultural practitioners, and resource managers; (2) establish a baseline survey of intertidal and shallow subtidal ecosystems, specifically focused on 'opihi species associations, relative abundance, and reproductive cycles to better understand the implications and consequences of climate change on these communities; (3) determine the species present using joint morphological and molecular DNA analyses to characterize the biodiversity of the Hawaiian intertidal zone and their connectivity to one another across the archipelago; (4) to pinpoint the spawning timing of 'opihi and test where 'opihi larvae reside in the water column with plankton surveys; and (5) begin to explore the mechanisms of adaptation to climate change and speciation in the sea using 'opihi as a model system to elucidate the mechanisms by which divergent selection can lead to adaptive radiation of marine species.

Objectives 1& 2: To accomplish these goals, we conduct 20-60 belt transects per island located randomly at sites selected based on access, safety and weather conditions. The transect methodology and data collection sheets come from a series of joint retreats between the resource management agency, NGO, research scientist and cultural practitioner partners to develop the collaborative protocol we implement. The data sheet and collaborative protocol, are described in more detail in Kehau Springer's permit application. In brief, we survey a series of belt transects per island, in which teams mark the start of the transect by recording the GPS waypoints. We then lay a transect sash chain perpendicular to the shoreline (mauka to makai), from the highest marine animal on the shore to 15 ft deep. We attach colored cable ties to the sash chain to divide the transect into zones, and count all 'opihi by size class within each zone. We count all other visually identifiable intertidal organisms associated with the 'opihi and record the species present and the abundance of each along the transect lines. Next we estimate the percent cover of each algae species and collect a voucher specimen from each type of algae to confirm algal id later in the laboratory under a microscope. If algal turfs are present, we collect a 1cm2 voucher sample of each visually distinct turf type because turfs are typically composed of 10's of species and are not identifiable in the field. We then measure the x,y,z spatial coordinates of each zone boundary along the transect before measuring the "rugose" length of the transect laid to contour the exact surface distance of each zone. Each data sheet is double-checked and photographed in the field, and matched with a photograph of the entire transect and the conditions are recorded along with anything else noteworthy along the transect line. An additional photograph is taken every 25cm along the transect chain o capture each zone boundary.

We are conducting very near shore fish surveys in PMNM. In order to survey shallow very near shore fish populations, we employ a system involving 4 snorkelers that swim parallel to the shore within 0-20 m of the shore line that was surveyed with transects. Each snorkeler has a different task. Snorkeler 1 surveys benthic fish. Snorkeler 2 surveys silver fish. Snorkeler 3 surveys colorful fish. Each surveying snorkeler records the number of fish of each species that they see on the swimming transect and is equipped with a camera to photograph unknown species. In 2011 we developed lists of the most common fish observed in the very near shore habitat that we have used to develop data sheets for data recording. Snorkeler 4 video tapes the fish along the transect to serve as visual documentation of the different species present. The snorkelers are paired and swim side by side with a boat escort for safety. The length of the swimming transect is recorded from the boat using a gps and a stopwatch to give an idea of catch per unit effort, but our primary goal at this point is to record the species present. This approach

covers both objective (1) and (2), and subsequent laboratory examination of the samples will fulfill objective (3).

In order to track 'opihi reproductive cycles, we will continue the work started on our 2011 cruise where we targeted 50 'opihi per species per island for gonad index analysis in collaboration with Kehau Springer. There is evidence of a September 2011 spawning event in our previous data, therefore in 2012, our cruise is scheduled to bracket the September spawning period, from new moon to the first quarter. We plan to collect 25 individuals per species pre and post-spawning on Nihoa and Mokumanamana and preserve them by freezing them in liquid nitrogen. We will visit Mokupāpapa during the 'opihi spawning period, so we will collect our samples for gonad analysis when we arrive and right before we leave the island. In the laboratory, we will dissect the 'opihi to separate the gonad, the non-gonadal tissue, and the shell. The wet weight of the gonad and non-gonadal tissue will be weighed and compared to assess reproductive state for males and females before and after the spawning period which will allow us to determine if the 'opihi spawn in September 2012.

Often when fishery species are managed with a size limit, the size at reproductive maturity decreases due to evolutionary pressure for younger maturation. We are going to test this hypothesis by comparing the size of reproductive maturity for 'opihi inside and outside of PMNM, which has never been done. To do this, 10 *C. sandwicensis* and 10 *C. exarata* will be collected for each of the following size classes on each island: <10mm, 10-15mm, 15-20mm, 20-25mm, and 25-30mm. The 'opihi will be frozen and analyzed for gonad index in the laboratory with the other 'opihi.

Objective 3, connectivity: The target species we have identified for genetic assessment are ones which are abundant and common on every island surveyed to date, and for which the estimated population sizes are so large that collection of 50 individuals per island will have no detectable impact. Our cut off is that we will not sample more than 1% of the population at any site, and preliminary abundance surveys from previous years indicate that populations are well in excess of 5000 individuals per island for each of the species that we have included on this permit application. We will examine connectivity of the intertidal species to compare with the subtidal organisms scored to date and determined whether coral reef species are a good predictor of intertidal species connectivity. DNA samples will be analyzed using standard techniques well–established in the field and in use daily in our lab (see attached CV).

Objective 4, pinpointing the timing of 'opihi spawning, requires the deployment of two egg basket buoy lines while we are stationed at an island (Figure 1). Egg baskets are 1.5" diameter x 3" long PVC tubes with 20um nitex mesh enclosing 'opihi eggs. If sperm is released by opihi, the eggs in the baskets become fertilized and we can determine the timing of spawning release by the stage of zygotic development. Between the ocean surface and 15 ft deep, 10 egg baskets will be attached to two temporary, simple anchor and buoy lines. The anchor will be placed on rock or sand to avoid damaging corals, the line will be tight to avoid fouling, and the lines will be monitored while deployed. Egg baskets will be changed out at 8am and 5pm, daily while the buoy lines are deployed. After collection, the contents of the egg baskets will be fixed in 95% ethanol and analyzed in the laboratory after the completion of the cruise. Timing of spawning is determined by taking the time of collection and subtracting the time it takes for an 'opihi to develop from fertilization to the observed stage (we have developed standard curves).

There will be seven sets of egg basket deployments; three on Mokumanamana and four on Mokupāpapa. For each deployment, five *Cellana exarata* and five *Cellana sandwicensis* will be collected, dissected, and strip-spawned at the time of deployment. Eggs from females will be combined within species, and partitioned among 10 egg baskets per species. For the entire cruise, 70 'opihi will be collected for egg basket activities. In order to maximize our use of these 'opihi, we will additionally collect a 200 mg tissue sample for DNA analysis and the 'opihi will be used in protocols outlined in Kehau Springer's permit application.

Identifying the location of 'opihi larvae, involves sampling plankton in the field and analyzing the samples in the lab for 'opihi. In the field, we use a 5hp gasoline powered water pump with a 100 ft hose to sample water from specific depths from the main ship (Searcher). Here we will take samples from the surface, 30ft, and 60ft. Three samples will be collected from each of the three depths for 11 days of the trip (99 samples in total). Samples will be 300 gallons filtered through 10um nitex plankton nets and preserved in 95% ethanol. In addition to pump samples, we will collect 9 plankton tow samples from a zodiac on each shore day (10 shore days, 90 samples) using an 80um, 0.5m plankton net. Each transect will be five minutes at 5mph at the surface, parallel to the island's shore line. Tows will be conducted at three distances from the shore: >20m, 50m, and 100m.

Objective 5, climate change resistance and adaptation of 'opihi. LePerouse Pinnacles at Mokupāpapa is the only island where 'opihi makaiauli and 'opihi 'alinalina are morphologically identical and reside in the same habitat above the crustose coralline algae zone due to an evolutionary shift in 'alinalina to the hotter and drier high shore. We are proposing to extract additional data from 'opihi specimens that are being collected for reproductive and DNA analysis, but subjecting them to heat stress tests that will allow us to directly test for differential adaptations and capacity to tolerate a warming climate among species and islands. 'Alinalina at LaPerouse Pinnacles can provide a window into the future for 'alinalina on other islands because they are already inhabiting a hotter section of the shoreline. We propose to expose the 'opihi to three different three hour temperature trials aboard the ship at 25°C, 35°C, and 45°C. During the trials, 'opihi behaviors such as locomotion and venting (where the shell is lifted off the surface) will be recorded. At the conclusion of each trial, the 'opihi will be flash frozen and put under liquid nitrogen. In the laboratory, in addition to gonad and DNA analysis, tissue samples will be taken for transcriptome RNAseq gene expression analyses and protein expression analysis. Important comparisons include those between (1) *C. sandwicensis* on Mokupāpapa and other islands where *C. sandwicensis* resides lower on the shore; (2) *C. sandwicensis* and *C. exarata*. In combination with RAD DNA sequencing we will both identify genes differentially expressed and survey their genetic diversity in order to assess the molecular capacity of 'opihi to tolerate rising temperatures.

NOTE: If land or marine archeological activities are involved, contact the Monument Permit Coordinator at the address on the general application form before proceeding, as a customized application will be needed. For more information, contact the Monument office on the first page of this application

9a. Collection of specimens - collecting activities (would apply to any activity): organisms or objects (List of species, if applicable, attach additional sheets if necessary):

Common name:

Yellowfoot ʻopihi(ʻopihi ʻalinalina)
Blackfoot ʻopihi(ʻopihi makaiauli)
Shingle urchin (hāʻukeʻuke kaupali)
Black nerite (pipipi)
Spotted periwinkle (pipipi kōlea)
Spotted drupe (makaloa)
Black purse shell (nahawele)
Thin shell rock crab (ʻaʻama)
Rock-boring urchin (ʻina kea)
Oblong urchin (ʻina)
Turf algae (limu)
see Appendix 1 for detailed list of samples.
Scientific name:
Cellana exarata
Cellana sandwicensis
Nesochthamalus intertextus
Isognomon californicum
Smaragdinella calyculata
Grapsus tenuicrustatus
Entomacrodus marmoratus
Istiblennius zebra
Drupa ricina
Echinolittorina hawaiiensis
Littoraria pintado
Nerita picea
Siphonaria normalis
Colobocentrotus atratus
Echinometra oblonga
Echinometra mathaei

& size of specimens:

Following above, see Appendix 1 for detailed list of maximum sample sizes

Collection location:

Following above, see Appendix 1 for detailed list of collection sites

☒ Whole Organism ☒ Partial Organism

9b. What will be done with the specimens after the project has ended?

Preserved samples remain the property of the Monument, and will maintained with population preserved connectivity biopsy tissue samples collected to date at HIMB, Texas A&M, and Scripps until they are used up by the study or such time as the Monument co-trustees request that they be returned to them. Taxonomic voucher specimens will be submitted for permanent inclusion in museum collections as per the voucher specimen guidelines.

We additionally request that specimens from the 2011 cruise be allowed to be transported to Texas A&M and Scripps for processing.

9c. Will the organisms be kept alive after collection? ☒ **Yes** ☒ **No**
'opihi for heat stress experiments will need to be kept alive for a short period of time, less than 6 hours. The 'opihi will be euthanized by freezing before the ship arrives at another atoll.

• General site/location for collections:

• Is it an open or closed system? ☐ Open ☒ Closed
Closed aquarium systems with water changes done by hand.

• Is there an outfall? ☐ Yes ☒ No
Any water from the aquarium will be treated and dumped into the ships ballast tanks during manual water changes as needed to maintain the health of the animals.

• Will these organisms be housed with other organisms? If so, what are the other organisms?
No.

• Will organisms be released?
No.

10. If applicable, how will the collected samples or specimens be transported out of the Monument?

Preserved samples (frozen, in ethanol, or saturated salt buffer) will be transported back to Oahu aboard the vessel. Specimens will be centrally housed at Texas A&M where Chris Bird can ensure their safe storage, preservation and care. Algae samples will be shipped to Jenn Smith and Levi Lewis at Scripps for identification and then will be housed at Texas A&M. Specimens may also be shipped to HIMB for processing. Voucher specimens will be subsampled for genetic analysis and stored frozen or in preservative prior to study.

Chris Bird – [redacted]

[redacted]

Jen Smith - [redacted]

11. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:

All researchers working on this project have coordinated to share samples and avoid duplicate sampling. Specifically, the samples listed here and those in the accompanying permit application by Kehau Springer are explicitly the same samples and not duplicative or in addition to one another.

12a. List all specialized gear and materials to be used in this activity:

We will collect samples by hand using no specialized gear or materials beyond snorkeling gear, transect lines, data sheets, and butter knives. A 5hp gasoline powered water pump run from the boat will be used to direct water through a 10um plankton net. Egg baskets are 1.5" diameter x 3" long PVC tubes with 20um nitex mesh enclosing 'opihi eggs. If sperm is released by opihi, the eggs in the baskets become fertilized and we can determine the timing of spawning release by the stage of zygotic development. Between the ocean surface and 15 ft deep, Egg baskets will be attached to two temporary, simple anchor and buoy lines. The anchor will be placed on rock or sand to avoid damaging corals (placement will be confirmed visually by free diving) the line will be tight to avoid fouling, the lines will be monitored while deployed, and no supplies/gear will be left behind at any island (Figure 1).

12b. List all Hazardous Materials you propose to take to and use within the Monument:

Tissue preservative solutions for DNA analyses include: 95% ethanol (EtOH), MSDS attached, and saturated salt buffer with dimethyl sulfoxide (DMSO), MSDS attached. Both EtOH and DMSO are commonly sold for human consumption, and should not pose any significant health or environmental risk.

13. Describe any fixed installations and instrumentation proposed to be set in the Monument:

None

14. Provide a time line for sample analysis, data analysis, write-up and publication of information:

Surveys will be completed in the field during the expedition. Data analysis and write-up will depends on the availability of specific support for researchers post-cruise. With current levels of partial support and volunteer activities, we expect it will take roughly an additional year to complete the post-cruise analysis of survey data. Time to publication can be considerably longer since the turn-around time for some journals now exceeds 800 days, but results will be reported as soon as possible among the partners and to the resource management community.

Regardless of the time to publication, the results from these studies are made available to Monument managers as quickly as possible through the brown-bag luncheons, semi-annual reports, and semi-annual mini symposium during which all researchers involved in this project present the most current findings from their ongoing research to the broader management community. Findings are always provided to the Monument co-trustees almost as quickly as they become available, and made available to the greater management community within no more than 6 months of the data being collected. Finally, given the specific partnership of Hawaiian cultural practitioners, NGO community, State and Federal resource managers, and research scientists, we are confident that research results will be communicated widely.

Additionally this permit application is a partner to the Native Hawaiian Practices permit application of Kehau Springer. All samples and methodologies discussed in this permit application are directly related to both permit applications and are the same samples, not in addition to one another. This project and its group of dedicated participants will continue to bridge the gap between cultural and western research in Papahānaumokuākea Marine National Monument, and community participants will communicate our collective findings to their respective communities (Hana, Kalapana, etc.) as outlined in Kahau Springer's permit application.

Tentative Cruise Itinerary

DATE	PORT / Island	Departure Time	Distance	Spawning Period	Activities
09/12/2012	Depart Kewalo for Nihoa (NIH)	0900	245nm @ 8 knots = 31 hrs	Pre-Spawn	
09/13/2012	Arrive NIH	SEARCHER arrive NIH, anchor in pm – scout coastline via small boat		Pre-Spawn	Collect, Plankton
09/14/2012	NIH	½ day operations @ NIH; 1400 departure for MMM	122nm @ 8 knots = 16 hrs	Pre-Spawn	Collect, Transect, Plankton
09/15/2012	Arrive MMM	Full day operations at MMM		Pre-Spawn	Collect, Transect, Plankton
09/16/2012	MMM - transit	½ day operations @ MMM; 1100 departure for FFS	155nm @ 8 knots =	Spawning	Fish, Egg Basket, Plankton

			20 hrs		
09/17/2012	FFS	Arrive FFS, ½ day operations		Spawning	Collect, Egg Basket, Plankton, Fish
09/18/2012	FFS	Full day operations @ FFS		Spawning	Transect, Egg Basket, Plankton
09/19/2012	FFS	Full day operations @ FFS; depart for MMM in pm	155nm @ 8 knots = 20 hrs	Spawning	Transect, Egg Basket, Plankton Collect
09/20/2012	Arrive MMM	SEARCHER anchor in pm – scout coastline via small boat		Spawning	Egg Basket, Plankton
09/21/2012	MMM	Full day operations @ MMM depart for NIH around 1600	122nm @ 8 knots = 16 hrs	Spawning	Transect, Egg Basket, Plankton, Collect
9/22/2012	NIH	Full day operations @ NIH		Post-Spawning	Transect, Fish, Plankton
09/23/2012	NIH	Full day operations @ NIH, depart at 1600 to HNL	245nm @ 8 knots = 31 hrs	Post-Spawning	Transect, Plankton
09/24/2012	NIH – transit	Transit – arrive 11pm-ish			
09/25 or 9/26	offload				

15. List all Applicants' publications directly related to the proposed project:

21 Simion, P, CE Bird, and RJ Toonen (in prep) Comparative phylogeography of *Octopus cyanea* and *O. oliveri* in the Hawaiian Archipelago.

20 Bird, CE, BH Holland, P Samallow, BW Bowen, and RJ Toonen (in prep) Shell game: spatially variable morphological convergence revealed by DNA analysis in sibling limpets.

19 Bird, CE, M Iacchei, and RJ Toonen (in prep) Isolation, disruptive selection, and divergence within a population of broadcast-spawning limpets.

18 Bird, CE and RJ Toonen (in prep) Patterns of recent divergence and gene flow between budding lineages and species boundaries in the sibling Hawaiian limpets (*Cellana* spp.)

17 Bird, CE, MA Timmers, PE Smouse and RJ Toonen (in review) Inferring dispersal patterns with F_{ST} and $\square_{ST}$: when is genetic distance is too much information? Integrative and Comparative Biology. *Invited*

16 Bird, CE, E Franklin, RJ Toonen, & CM Smith (in review) Between wave and tide marks: a unified model of water level and vertical zonation on littoral shores.

15 Bird, CE, M Stat, RD Gates, & RJ Toonen (in review) Complex analysis of molecular variance with PERMANOVA+.

14 Bird, CE, D Skillings, I Fernandez, and RJ Toonen (in press) Sympatric speciation in the post Modern Synthesis era of evolutionary biology. Evolutionary Biology. *Invited* Special issue on speciation.

13 Padilla-Gamino, JL, X Pochon, CE Bird, G Concepcion, RD Gates (in press) From parent to gamete: vertical transmission of *Symbiodinium* (Dinophyceae) in the scleractinian coral Montipora capitata.

12 Forsman, Z, B Kimokeo, CE Bird, CL Hunter & RJ Toonen (2012) Coral farming: species-specific effects of light, water motion and artificial foods. Journal of the Marine Biological Association of the UK.

11 Timmers, MA, CE Bird, DJ Skillings, PE Smouse, and RJ Toonen (2012) There's no place like home: crown-of-thorns outbreaks in the central Pacific are locally derived and independent events. PLoS ONE.

10 Bird, CE, PE Smouse, SA Karl & RJ Toonen (2011) Detecting and measuring genetic differentiation. In: S. Koenemann, C. Schubart & C. Held (eds.) Crustacean Issues: Phylogeography and Population Genetics in Crustacea. 31-73.*Invited*

9 Bird, CE (2011) Morphological and behavioral evidence for adaptive diversification of sympatric Hawaiian limpets. Journal of Integrative and Comparative Biology. 51:466-473.

8 Bird, CE, B Holland, BW Bowen & RJ Toonen (2011) Diversification of sympatric broadcast-spawning limpets (*Cellana* spp.) within the Hawaiian archipelago. Molecular Ecology. 20:2128-2141.

7 Gaither, MR , Z Szabo, M Crepeau, CE Bird & RJ Toonen (2011) Preservation of corals in salt-saturated DMSO buffer is superior to ethanol for PCR experiments. Coral Reefs. 30: 329-333.

6 Toonen, RJ, K Andrews, I Baums, CE Bird, G Concepcion, T Daly-Engel, J Eble, A Faucci, M Gaither, M Iacchei, J Puritz, J Schultz, D Skillings, M Timmers & B Bowen (2011) Defining boundaries for ecosystem-based management: a multispecies case study of marine connectivity across the Hawaiian archipelago. Journal of Marine Biology Article ID 460173, 15pp. doi:10.1155/2011/460173

5 Stat, M, CE Bird, X Pochon, L Chasqui, LJ Chauka, GT Concepcion, D Logan, M Takabayashi, RJ Toonen & RD Gates (2011) Variation in *Symbiodinium* ITS2 sequence assemblages among coral colonies. PLoS ONE 6(1): e15854. doi:10.1371/journal.pone.0015854

4 Skillings, D, CE Bird & RJ Toonen (2011) Gateways to Hawai'i – genetic population structure of the tropical sea cucumber *Holothuria atra*. Journal of Marine Biology. Article ID 783030, 16 pp

3 Timmers, MA, K Andrews, CE Bird, MJ deMaintenon, RE Brainard & RJ Toonen (2011) Widespread dispersal of the crown-of-thorns sea star, *Acanthaster planci*, across the Hawaiian Archipelago and Johnston Atoll. Journal of Marine Biology. Article ID 934269, 10 pp. doi:10.1155/2011/934269

2 Rodgers, KS, PL Jokiel, CE Bird, & EK Brown (2009) Quantifying the condition of Hawaiian coral reefs. Aquatic Conservation. 20:93-105.

1 Bird, CE, BS Holland, BW Bowen & RJ Toonen (2007) Contrasting phylogeography in three endemic Hawaiian limpets (*Cellana* spp.) with similar life histories. Molecular Ecology. 16:3173-3187.

With knowledge of the penalties for false or incomplete statements, as provided by 18 U.S.C. 1001, and for perjury, as provided by 18 U.S.C. 1621, I hereby certify to the best of my abilities under penalty of perjury of that the information I have provided on this application form is true and correct. I agree that the Co-Trustees may post this application in its entirety on the Internet. I understand that the Co-Trustees will consider deleting all information that I have identified as "confidential" prior to posting the application.

Signature Date

SEND ONE SIGNED APPLICATION VIA MAIL TO THE MONUMENT OFFICE BELOW:

Papahānaumokuākea Marine National Monument Permit Coordinator
6600 Kalaniana'ole Hwy. # 300
Honolulu, HI 96825
FAX: (808) 397-2662

DID YOU INCLUDE THESE?
☒ Applicant CV/Resume/Biography
☒ Intended field Principal Investigator CV/Resume/Biography
☒ Electronic and Hard Copy of Application with Signature
☒ Statement of information you wish to be kept confidential
☒ Material Safety Data Sheets for Hazardous Materials

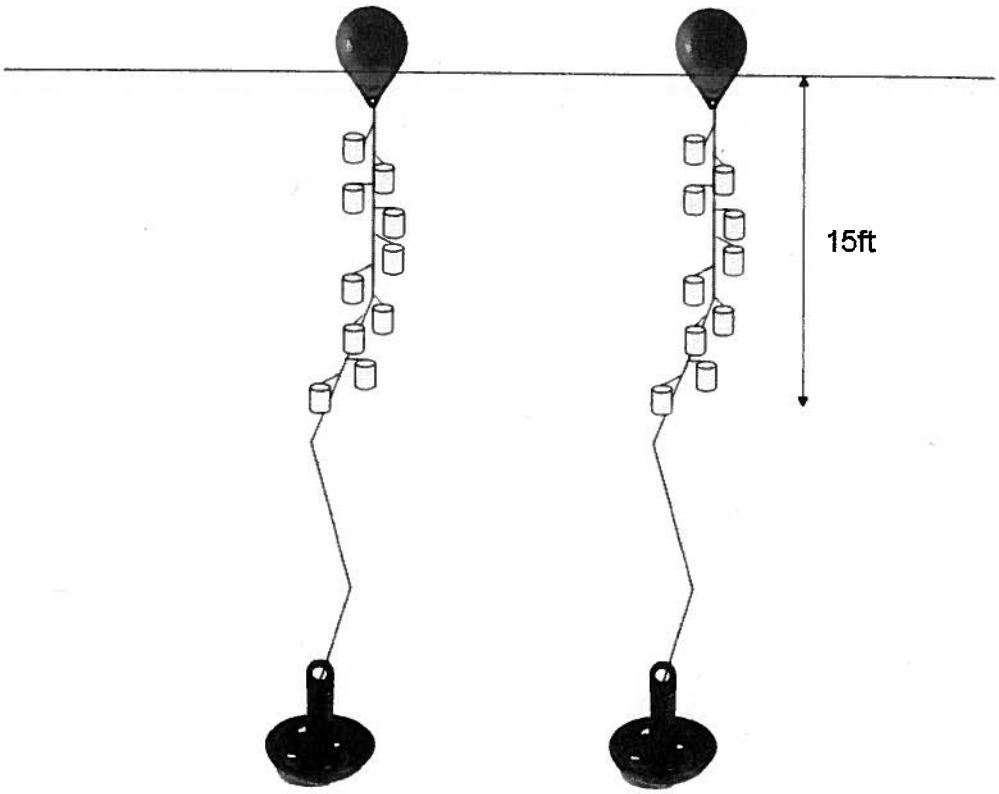
Appendix 1.

2012 Collection List

Species	Type	Distribution	Sampling	Nihoa	Mokumanamana	Mokupāpapa	Pūhāhonu	Preserve Tissue For Genetic Analysis
Nesochthamalus intertextus	Barnacle	Hawaii	Lethal	0	0	50	50	Y
Isognomon californicum	Bivalve	Hawaii	Lethal	0	0	0	50	Y
Smaragdinella calyculata	Bubble Shell	Indo-Pac	Lethal	0	50	50	50	Y
Grapsus tenuicrustatus	Crab	Indo-Pac	Non-lethal	23	22	0	50	Y
Entomacrodus marmoratus	Fish	Hawaii	Non-lethal	42	50	45	50	Y
Istiblennius zebra	Fish	Hawaii	Non-lethal	0	49	50	50	Y
Drupa ricina	Snail	Indo-Pac	Non-lethal	0	49	7	50	Y
Echinolittorina hawaiiensis	Snail	Hawaii	Lethal	0	0	0	50	Y
Littoraria pintado	Snail	Indo-Pac	Lethal	0	0	0	50	Y
Nerita picea	Snail	Hawaii	Lethal	0	0	48	50	Y
Siphonaria normalis	Snail	Indo-Pac	Lethal	198	157	190	200	Y
Colobocentrotus atratus	Urchin	Indo-Pac	Lethal	0	0	47	50	Y
Echinometra oblonga	Urchin	Indo-Pac	Non-lethal	0	50	42	50	Y
Echinometra mathaei	Urchin	Indo-Pac	Non-lethal	0	50	50	50	Y
Cellana exarata	Limpet	Hawaii	Lethal	100	115	120	50	Y
Cellana exarata eggs (from specimens listed above) *	Limpet	Hawaii	Lethal	0	Up to 3x10^6 *	Up to 4x10^6 *	0	Y
Cellana sandwicensis	Limpet	Hawaii	Lethal	100	115	120	50	Y
Cellana sandwicensis eggs (from specimens listed above)	Limpet	Hawaii	Lethal	0	Up to 3x10^6 *	Up to 4x10^6 *	0	Y
Misc Algae	algae	various	Non-lethal	1000	1000	1000	1000	Y

*estimated number of eggs determined assuming 200,000 eggs per female and all 'opihi collected for egg baskets being female.

Figure 1. Egg basket deployment aparatus



Papahānaumokuākea Marine National Monument
Compliance Information Sheet

1. Updated list of personnel to be covered by permit. List all personnel names and their roles here (e.g. John Doe, Diver; Jane Doe, Field Technician, Jerry Doe, Medical Assistant):

1. Hoku Johnson (Chief Scientist)
2. Shauna Kehaunani Springer (PI for NH Practices Permit)
3. Christopher Bird (PI for Research Permit)
4. Levi Lewis (Researcher – Phycologist)
5. Patrick Springer (Researcher & Medical Assistant)
6. Mikala Minn (Researcher)
7. Brian Viliarimo (Researcher)
8. Makani Gregg (Researcher)
9. Albert Espaniola (Researcher)
10. 1 TBD

2. Specific Site Location(s): (Attach copies of specific collection locations):
Habitat: Intertidal zone to 20ft subtidal
Substrate: Basalt
Islands / Atolls:
French Frigate Shoals – La Perouse Pinnacles
Mokumanamana
Nihoa

3. Other permits (list and attach documentation of all other related Federal or State permits):
This permit will be conducted alongside Research Permit Number PMNM-2012-052.

3a. For each of the permits listed, identify any permit violations or any permit that was suspended, amended, modified or revoked for cause. Explain the circumstances surrounding the violation or permit suspension, amendment, modification or revocation.
None

4. Funding sources (Attach copies of your budget, specific to proposed activities under this permit and include funding sources. See instructions for more information):
This trip is fully supported by NOAA / NOS / Office of National Marine Sanctuaries, Papahānaumokuākea Marine National Monument, in partnership with the Hawaii Institute of Marine Biology, Texas A&M University Corpus Christi, Scripps Institute of Oceanography, and UC San Diego.

5. Time frame:
Activity start: 2009
Activity completion: ongoing

Dates actively inside the Monument:
From: 6 August 2013
To: 18 August 2013

Describe any limiting factors in declaring specific dates of the proposed activity at the time of application:
None

Personnel schedule in the Monument:
Please see draft itinerary attached.

6. Indicate (with attached documentation) what insurance policies, bonding coverage, and/or financial resources are in place to pay for or reimburse the Monument trustees for the necessary search and rescue, evacuation, and/or removal of any or all persons covered by the permit from the Monument:
This project is fully supported by the Office of National Marine Sanctuaries. The Federal Government is self-insured. In addition, cruise participants will carry emergency evacuation insurance (e.g. DAN insurance or something compatible).

7. Check the appropriate box to indicate how personnel will enter the Monument:

☒ Vessel
☐ Aircraft

Provide Vessel and Aircraft information: SEARCHER

8. The certifications/inspections (below) must be completed prior to departure for vessels (and associated tenders) entering the Monument. Fill in scheduled date (attach documentation): Documentation of all inspections will be provided prior to departure. Hull, tender, ballast water, gear/equipment inspections cannot occur until two weeks prior to departure.

☒ Rodent free, Date: TBD
☒ Tender vessel, Date: TBD
☒ Ballast water, Date: TBD
☒ Gear/equipment, Date: TBD
☒ Hull inspection, Date: TBD

9. Vessel information (NOTE: if you are traveling aboard a National Oceanic and Atmospheric Administration vessel, skip this question):
Vessel name: SEARCHER
Vessel owner: The Medical Foundation for the Study of the Environment
Captain's name: Jonathan Littenberg
IMO#: 192
Vessel ID#: U.S. Coast Guard 1103056
Flag: U.S.
Vessel type: Steel Hull
Call sign: WDA 6100
Embarkation port: Honolulu
Last port vessel will have been at prior to this embarkation: Honolulu
Length: LOA/96 ft. Registered 78.1 ft.
Gross tonnage: 197
Total ballast water capacity volume (m3): N/A
Total number of ballast water tanks on ship: N/A
Total fuel capacity: 9,600 gallons
Total number of fuel tanks on ship: 6
Marine Sanitation Device: Yes
Type: II

Explain in detail how you will comply with the regulations regarding discharge in the Monument. Describe in detail. If applicable, attach schematics of the vessel's discharge and treatment systems: All materials and fluids shall be properly stored in holding tanks while vessel is in Monument waters and will be properly treated and disposed of upon our exit from the Monument.

Other fuel/hazardous materials to be carried on board and amounts: Approximately 30 gallons of unleaded fuel in jerry cans for use in the skiffs.

Provide proof of a National Oceanic and Atmospheric Administration (NOAA) Office of Law Enforcement-approved Vessel Monitoring System (VMS). Provide the name and contact information of the contractor responsible for installing the VMS system. Also describe VMS unit name and type: Vessel Monitoring System – Thrane & Thrane Sailor TT – 3606XP

VMS Email: 436998398@c12.stratoemobile.net
Inmarsat ID#: 4TT072E62B15
Contact: Jonathan Littenberg (808.225.8982) or Barbara Littenberg (808.221.6156)

* Individuals MUST ENSURE that a type-approved VMS unit is installed and that its automatic position reports are being properly received by the NOAA OLE system prior to

the issuance of a permit. To make sure your VMS is properly configured for the NOAA OLE system, please contact NOAA OLE at (808) 203-2503 or (808) 203-2500.

* PERMITS WILL NOT BE ISSUED TO INDIVIDUALS ENTERING THE MONUMENT VIA VESSEL UNTIL NOAA OLE HAS CONTACTED THE MONUMENT PERMIT COORDINATOR WITH A 'POSITIVE CHECK' READING.

10. Tender information:

On what workboats (tenders) will personnel, gear and materials be transported within the Monument? List the number of tenders/skiffs aboard and specific types of motors:
One 16 foot RHIB zodiac with Yamaha 4 stroke engine and one 16 foot inflatable Avon with Yamaha 4 stroke tiller engine.

Additional Information for Land Based Operations

11. Proposed movement of personnel, gear, materials, and, if applicable, samples:
none

12. Room and board requirements on island:
none

13. Work space needs:
none

DID YOU INCLUDE THESE?
☐ Map(s) or GPS point(s) of Project Location(s), if applicable
☐ Funding Proposal(s)
☐ Funding and Award Documentation, if already received
☐ Documentation of Insurance, if already received
☐ Documentation of Inspections
☐ Documentation of all required Federal and State Permits or applications for permits

ATTACHMENT 1 – MOVEMENT OF PERSONNEL

Itinerary:

NIH = Nihoa
MMM = Mokumanamana (Necker) Island
FFS = French Frigate Shoals (La Perouse Pinnacles)

Date	Location
8/6/2013	Scientific party board ship at 1500. Departure from Kewalo Basin at 1600
8/7/2013	Transit
8/8/2013	Transit
8/9/2013	Arrive FFS, full day operations
8/10/2013	Full day ops at FFS
8/11/2013	¾ day ops at FFS, depart for MMM at 1600
8/12/2013	Arrive MMM, full day operations
8/13/2013	Full day ops at MMM
8/14/2013	¾ day ops at MMM, depart for NIH at 1500
8/15/2013	Arrive NIH, ½ day operations in pm
8/16/2013	Full day ops at NIH
8/17/2013	¾ day ops at NIH, depart for HNL at 1600
8/18/2013	Transit – arrive HNL at 11pm-ish
8/19 or 8/20	Offload

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ESTHER KIA'AINA
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 26, 2013

TO: Division of Aquatic Resources File

THROUGH: William J. Aila, Jr., Chairperson

FROM: William Tam
Water Deputy and Acting Administrator, Division of Aquatic Resources

SUBJECT:

DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200 HAR, FOR AN AMENDMENT TO PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMIT ISSUED TO DR. ROBERT TOONEN, UNIVERSITY OF HAWAII, HAWAII INSTITUTE OF MARINE BIOLOGY, AND DR. CHRISTOPHER BIRD, TEXAS A&M UNIVERSITY – CORPUS CHRISTI, FOR ACCESS TO STATE WATERS TO CONDUCT INTERTIDAL BIODIVERSITY SURVEY ACTIVITIES UNDER PERMIT PMNM-2012-049.

The following permitted activities are found to be exempted from preparation of an environmental assessment under the authority of Chapter 343, HRS and Chapter 11-200, HAR:

Project Title:
Amendment to Papahānaumokuākea Marine National Monument Research Permit, PMNM-2012-049, issued to Dr. Robert Toonen, University of Hawaii, Hawaii Institute of Marine Biology, and Dr. Christopher Bird, Texas A&M University – Corpus Christi, for Access to State Waters to Conduct Intertidal Biodiversity Survey Activities

Permit Number: PMNM-2012-049

Project Description:
The amendment to the research permit application, as described below, would allow entry and activities to occur in Papahānaumokuākea Marine National Monument (Monument), including the NWHI State waters from August 1 to August 31, 2013.

In the amendment, the applicants propose to continue with their research objectives and permitted activities. They are requesting additional samples of previously approved species and to sample seven species not included in the original approved permit. Three of the new species not previously permitted will be sampled non-lethally (*Octopus oliveri, Octopus cyanea,* and

Actinopya maurittiana) and four will be sampled via lethal methods (*Heterocentrotus mammilatus, Echinothrix diadema, Acanthaster planci,* and *Tripneustes gratilla*) (*Octopus oliveri, Octopus cyanea,* and *Actinopya maurittiana*) and four will be sampled via lethal methods (*Heterocentrotus mammilatus, Echinothrix diadema, Acanthaster planci,* and *Tripneustes gratilla*).

The objectives of the approved permit include collecting samples of common intertidal invertebrates, fish, and algae by hand and plankton by net in order to establish an intertidal baseline survey of the NWHI, that would characterize the biodiversity, and explore the mechanisms of genetic speciation in the sea.

The proposed activities in the amendment are in direct support of the Monument Management Plan's priority management need 3.1 – Understanding and Interpreting the NWHI (through action plan 3.1.1 – Marine Conservation Science). This action plan warrants projects that "measure connectivity and genetic diversity of key species to enhance management decisions." Activities such as those to be carried out by the permittees are also addressed in the Monument Management Plan Environmental Assessment (December 2008) which resulted in a FONSI. Identification of biodiversity and genetic diversity of invertebrates in the NWHI, such as those proposed, would enhance this understanding.

Consulted Parties:
The permit application was sent out for review and comment to the following scientific and cultural entities: Hawaii Division of Aquatic Resources, Hawaii Division of Forestry and Wildlife, Papahānaumokuākea Marine National Monument (NOAA/NOS), NOAA Pacific Islands Regional Office (NOAA-PIRO), United States Fish and Wildlife Service Hawaiian and Pacific Islands National Wildlife Refuge Complex Office, and the Office of Hawaiian Affairs (OHA). In addition, the permit application has been posted on the Monument Web site since June 29, 2012, giving the public an opportunity to comment. The application was posted within 40 days of its receipt, in accordance with the Monument's Public Notification Policy.

The amendment was also sent out for review and comment to the agencies listed. Amendments to approved permits are not required to be posted on the Monument Web site.

Exemption Determination:
After reviewing HAR § 11-200-(8), including the criteria used to determine significance under HAR § 11-200-12, DLNR has concluded that the activities under this permit would have minimal or no significant effect on the environment and that issuance of the permit is categorically exempt from the requirement to prepare an environmental assessment based on the following analysis:

1. All activities associated with this permit, including transect monitoring, tissue biopsy sampling, and subsequent genetic and taxonomic study of reef fish, algae, and invertebrates, have been evaluated as a single action. As a preliminary matter, multiple or phased actions, such as when a group of actions are part of a larger undertaking, or when an individual project is precedent to or represents a commitment to a larger project, must be grouped together and evaluated as a single action. HAR § 11-200-7. Since this permit involves an activity that is precedent to a later planned activity, i.e. the continuation of nearshore biodiversity monitoring

and sampling and associated genetic studies, the categorical exemption determination here will treat all planned activities as a single action.

2. The Exemption Class for Scientific Research with no Serious or Major Environmental Disturbance Appears to Apply. Chapter 343, HRS, and section 11-200-8, HAR, provide for a list of classes of actions exempt from environmental assessment requirements. HAR §11-200-8.A.5. exempts the class of actions which involve "basic data collection, research, experimental management, and resource evaluation activities, which do not result in a serious or major disturbance to an environmental resource." This exemption class has been interpreted to include fisheries research related to the development and management of various aquatic organisms, including life history, migration, and growth studies, such as those being proposed.

Additionally, Exemption Class #5, Exempt Item #2 includes game and non-game wildlife surveys, photographing, recording, sampling, and collection in the field. DEPARTMENT OF LAND & NATURAL RESOURCES, EXEMPTION LIST FOR THE DIVISION OF FORESTRY AND WILDLIFE (June 12, 2008).

The proposed genetic and biodiversity activities here appear to fall squarely under the exemption class identified under HAR § 11-200-8.A.5., and are succinctly described under the former Fish and Game Division exemption list published in 1976. As discussed below, no significant disturbance to any environmental resource is anticipated in either the proposed lethal specimen collection, non-lethal tissue biopsy sampling, or voucher specimen collections proposed by the applicants. Thus, so long as the below considerations are met, an exemption class should include the action now contemplated.

3. Cumulative Impacts of Actions in the Same Place and Impacts with Respect to the Potentially Particularly Sensitive Environment Will Not be Significant. Even where a categorical exemption appears to include a proposed action, the action cannot be declared exempt if "the cumulative impact of planned successive actions in the same place, over time, is significant, or when an action that is normally insignificant in its impact on the environment may be significant in a particularly sensitive environment." HAR § 11-200-8.B. To gauge whether a significant impact or effect is probable, an exempting agency must consider every phase of a proposed action, any expected primary and secondary consequences, the long-term and short-term effects of the action, the overall and cumulative effect of the action, and the sum effects of an action on the quality of the environment. HAR § 11-200-12. Examples of actions which commonly have a significant effect on the environment are listed under HAR § 11-200-12.

While the specific intent and goals of this project are unique, past projects have included similar collections and techniques with no adverse impact. Similar nearshore biodiversity monitoring activities have been permitted and performed within the NWHI. In addition, lethal and non-lethal genetic tissue sampling has also been undertaken in the marine environment within the Monument. Approved activities under this permit first occurred in September 2012. The species targeted for collection in this project are ones identified as being abundant and common on every island surveyed to date, for which the estimated population sizes are so large that the collection of 50 individuals per island would have no detectable impact. The applicants note that no more than 1% of the population at any site would be sampled. With this in mind, significant cumulative impacts are not anticipated as a result of this activity, and numerous safeguards further ensure that the potentially sensitive environment of the project area will not be

significantly affected. All activities will be conducted in a manner compatible with the management direction of the Monument Proclamation in that the activities do not diminish monument resources, qualities, and ecological integrity, or have any indirect, secondary, cultural, or cumulative effects. The joint permit review process did not reveal any anticipated indirect or cumulative impacts, nor did it raise any cultural concerns, that would occur as a result of these activities. Also, NOAA-ONMS has committed to monitoring the intertidal zones of Nihoa, Necker Island, and French Frigate Shoals annually in the same areas where this study is conducted.

The activities would be conducted from the NOAA Ship SEARCHER (PMNM-2013-001) during its August Intertidal cruise.

These activities will be conducted from a small boat deployed from the M/V SEARCHER around Nihoa Island, Necker Island (Mokumanamana), French Frigate Shoals (FFS), and Gardner Pinnacles. Activities permitted under permit no. PMNM-2012-052 to Ms. Shauna Kēhaunani Springer are anticipated to occur concurrently and are complementary to this study. The amendment for this permit is pending approval. These permits are not anticipated to have significant cumulative impacts.

Since no significant cumulative impacts or significant impacts with respect to any particularly sensitive aspect of the project area are anticipated, the categorical exemptions identified above should remain applicable.

4. Overall Impacts will Probably be Minimal and Insignificant.

Again, any foreseeable impacts from the proposed activity will probably be minimal, and further mitigated by general and specific conditions attached to the permit. Specifically, all research activities covered by this permit will be carried out with strict safeguards for the natural, historic, and cultural resources of the Monument as required by Presidential Proclamation 8031, other applicable law and agency policies and standard operating procedures.

Conclusion. Upon consideration of the permit to be approved by the Board of Land and Natural Resources, the potential effects of the above listed project as provided by Chapter 343, HRS and Chapter 11-200 HAR, have been determined to be of probable minimal or no significant effect on the environment and exempt from the preparation of an environmental assessment.

_____ _____

William J. Aila, Jr. Date

Chairperson, Board of Land and Natural Resources